

Species-limits of *Crocidura somalica* Thomas, 1895 and *Crocidura yankariensis* Hutterer and Jenkins, 1980 (Insectivora: Soricidae)

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Abstract

Additional information on the recently described *Crocidura yankariensis* is presented. The external characters are described for the first time, and distributional records are given for Sudan, Ethiopia, Kenya and Somalia. The species is also compared with *C. somalica*, and the species-limits of both are defined.

Introduction

After the description of *Crocidura yankariensis* (HUTTERER and JENKINS 1980) more material became known to us from various localities in Africa. HUTTERER and KOCK (1983) recorded the species from Kordofan, Sudan, where it was found in owl pellets, as was the type series from Nigeria. We are now able to report on the first complete specimens and to describe the external characters of the species. A re-examination of material studied by HAYMANN (1937), BEAUX (1937), FUNAIOLI and SIMONETTA (1960), HEIM DE BALSAC (1966), CORBET and YALDEN (1972) and YALDEN et al. (1976) revealed that these authors had already handled but misidentified specimens of *C. yankariensis*. As the newly described species is superficially similar to *C. somalica* Thomas, 1895, we found it necessary to define the limits of that species and to point out the differences between them.

Materials, Abbreviations

40 specimens of *C. yankariensis* were available, of which 4 were complete specimens preserved in alcohol, 5 skins with skulls, 3 single skulls, and 28 skull fragments from owl pellets. We examined also 25 *C. somalica*; 2 specimens in alcohol with skulls (Holotype and paratype), 2 skins with skulls, and 21 skull fragments from owl pellets. This material forms part of the collections of the following institutions (with identifying symbols in parentheses): British Museum (Natural History), London (BM[NH]), Hungarian Natural History Museum, Budapest (HNHM), Museo Zoologico della Specola, Firenze (MZF), Museo di Storia Naturale, Genova (MG), Senckenberg-Museum, Frankfurt (SMF), Staatliches Museum für Naturkunde, Stuttgart (SMNS), Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn (ZFMK), Harrison Zoological Museum, Sevenoaks (HZM).

Abbreviations for measurements used in the text are: HB = length of head and body; T = length of tail; HF = length of hindfoot without claws; E = length of pinna from base to outer margin; WT = weight in grams. Skull measurements: CI = Condylolincisive length; IW = least interorbital width; GW = greatest braincase width; HCC = height of braincase; UTR = length of upper toothrow. All measurements are in millimeters.

Accounts of species

Crocidura somalica Thomas, 1895

Crocidura somalica THOMAS, 1895: 52 (Galadi, Webi, Shebeli, Ethiopia); TROUSSERT, 1897: 199 (listed); DRAKE-BROCKMANN, 1910: 170 (listed); DOLLMANN, 1915: 511 (described); CABRERA, 1925: 158 (listed); ALLEN, 1939: 45 (listed); MOREAU, HOPKINS and HAYMAN, 1946: 397 (type locality fixed); SWYNNERTON, 1959: 188 (listed under the *fuscovirina* group); FUNAIOLI, 1971: 43 (discussed, figured); GUREEV, 1971: 175; 1979: 413 (listed); YALDEN, LARGEN and KOCK, 1976: 13–14 (listed), 9, 11 (figured), 69 (mapped, part only); HEIM DE BALSAC and MEESTER, 1977: 24 (listed, in part, specimen from Webi Shebeli); CORBET and HILL, 1980: 30 (listed); HARRISON, 1980: 387, 388 (Khadrafi, Oman; compared with holotype, figured); HUTTERER, 1981a: 222, 236 (Shifra, Danakil, Ethiopia), 237 (discussed), 238 (mapped); 1981b: 3, 4 (figured), 5, 6 (discussed), 7 (mapped, in part, specimen from Ethiopia only); HONACKI, KINMAN and KOEPEL, 1982: 82 (listed); DEMETER, 1982: 285 (Awash N. P. Ethiopia); HUTTERER and KOCK, 1983: 22 (Angolo, Sudan), 19, 21 (figured).

Holotype. Young female (BM[NH] 93.6.30.7.), preserved in spirit, skull extracted. "Webi Shebeli, Somaliland", restricted to Middle Webi Shebeli, about 5° 30' N, 44° E, near Geledi (= Galadi), Ethiopia, by MOREAU, HOPKINS and HAYMAN (1946).

Other material. Ethiopia: ♂ BM(NH) 94.1.8.2. (in alcohol, skull extracted) Webbi Shebeli; ♂ SMNS 24093 (skin and skull) Shifra, Danakil desert, 11° 40' N, 40° 00' E; 17 skulls from owl pellets, in HNHM and ZFMK, Awash N. P., 8° 56' N, 39° 57' E; Sudan: SMF 35939, 35944, 60243–4 (4 skulls from owl pellets) Angolo, Kordofan, 10° 31' N, 29° 53' E; Oman: ♂ HZM 1.9149 (skin and skull) Khadrafi, Dhofar, 16° 41' N, 53° 09' E.

Diagnosis and description. Size small, with HB 53–77 mm, T 40–47 mm, HF 11.2–13.0 mm, E 5–7.2 mm; WT about 8 grams. Colour description from THOMAS 1895: "General colour above slaty grey, more or less variegated with brown. Belly clearly grey; chin white. Ears whitish, vera finely haired. Hands and feet white. Tail fairly long, slender, not markedly incrassated, but yet thicker at its base, whence it evenly tapers to its tip; pale brown above, white below, the bristles white." The skin of SMNS 24093 agrees fairly well with Thomas's description except that the ears are not white, but brown. It has also a small white spot at the forehead. The dorsal hairs are 3–4 mm in length.

The skull (Fig. 9) is compared with that of *C. yankariensis* below. Measurements are shown in Table 1.

Distribution. Dry savannas and semi-desert areas of Ethiopia and Kordofan, Sudan. The species is not known from Somalia, although it probably occurs there. A single record from Oman, Arabia (HARRISON 1980).

Remarks. Poorly represented species, known only from a few localities. The record from Oman, Arabia is surprising, as it is the first record of an African shrew from the Arabian peninsula. The single specimen (HZM 1.9149) shows slight cranial differences from the holotype and paratype of *C. somalica*, mainly in the anterior part of the skull, in which the interorbital, maxillary and rostral regions are slightly narrower. However the general form of the skull, measurements and coloration are very similar to the specimens of *somalica* and we think it is correctly assigned to this species or represents a closely related

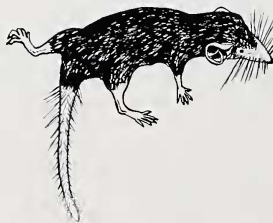


Fig. 1. *Crocidura yankariensis*. Drawing based on BM (NH) 55.618 from Kordofan, Sudan

form. Without additional specimens from Oman and of African *somalica* to give a clearer idea of variation within the species, it would be unwise to speculate further and at present the record of *somalica* from Oman should be accepted, with reservations.

Crocidura yankariensis Hutterer & Jenkins, 1980

Crocidura yankariensis HUTTERER and JENKINS, 1980: 305 (Futuk, Yankari Game Reserve, Nigeria); HONACKI, KINMAN and KOEPL, 1982: 84 (listed); HUTTERER and KOCK, 1983: 23 (Angolo, Sudan), 19, 21 (figured).

Crocidura somalica: BEAUX, 1937: 159 (Belet Amin, Somalia); HAYMAN, 1937: 531 (Kakuma, Kenya); FUNAIOLI and SIMONETTA, 1960: 105–107 (Afgoi, Somalia), 106 (figured); HEIM DE BALSAC, 1966: 201 (Afgoi and Belet Amin, Somalia), 202 (figured); KINGDON, 1974: 98 (figured), 99, 106 (mentioned); HEIM DE BALSAC and MEESTER, 1977: 24 (listed and described); HUTTERER, 1981b: 7 (mapped, in part).

Crocidura bicolor: CORBET and YALDEN, 1972: 225 (Bahar Dar, Ethiopia); YALDEN, LARGEN and KOCK, 1976: 10 (specimen from Bahar Dar).

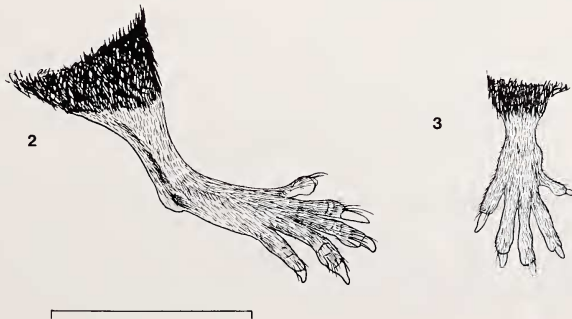
Holotype. HNHM 80.1.1., skull and mandible, from owl pellets, occipital region of skull missing. Futuk, 9° 50' N, 10° 55' E, near Yankari G. R., Nigeria.

Other material. Nigeria: further 12 skulls from Futuk and Wikki, Yankari G. R., now in HNHM, BM(NH) and ZFMK; Sudan: ? ♀ BM(NH) 55.618 (in alcohol, skull extracted) Kordofan, probably Kadugli, 11° 00' N, 29° 43' E; SMF 35936–8, 35940, 35942–3, 35945–6, 60245–6, ZFMK 82.143–7 (15 skulls from owl pellets), Angolo, Kordofan, 10° 31' N, 29° 53' E; Ethiopia: ♀ BM(NH) 70.530 (flat skin and skull) Bahar Dar, 11° 35' N, 37° 25' E; Kenya: ♀ BM (NH) 36.11.4.55 (in alcohol, skull extracted), W of Lake Rudolf, ? Kakuma, 3° 43' N, 34° 53' E; Somalia: MZF 2219, 2220, 2224–2227 (in alcohol, one skin, and skulls), Afgoi, 2° 08' N, 42° 07' E; MG 32908a, b, d (skins and skulls), Belet-Amin, 0° 11' N, 42° 47' E.

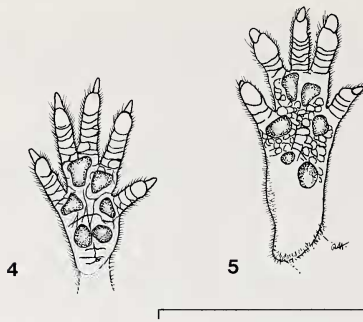
Diagnosis and description. A small shrew with HB 52–60 mm, T 35–41 mm, HF 9.5–10.1 mm, E 6–7.5 mm; WT about 5 grams. Body covered with short hairs, 2–3 mm in length. Basal parts of body hairs grey, dorsal hairs with brownish tips, ventral hairs with greyish tips. General appearance of dorsal fur olive-brown, of ventral fur smoke grey (in BM[NH] 55.618) or light greyish olive (MZF 2220, MG 32908a, b, d). No sharp line between dorsum and venter. The colour of BM(NH) 70.530 from Ethiopia is deep fuscous dorsally, and near light neutral grey ventrally; the specimen shows a more sharp transition line between dorsum and venter.

Muzzle from nose-tip to eyes without long bristles but covered with fine short brownish hairs. Whiskers long, up to 22 mm in length.

Ears (Fig. 7) large, covered with very fine short brownish hairs; long stiff bristles present along the inner folds, but less than in *C. somalica*; further details are shown in



Figs. 2–3. *Crocidura yankariensis* (BM [NH] 55.618); dorso-lateral aspect of the tibia and hindfoot (2) and dorsal aspect of forehand (3). (Scale 10 mm)

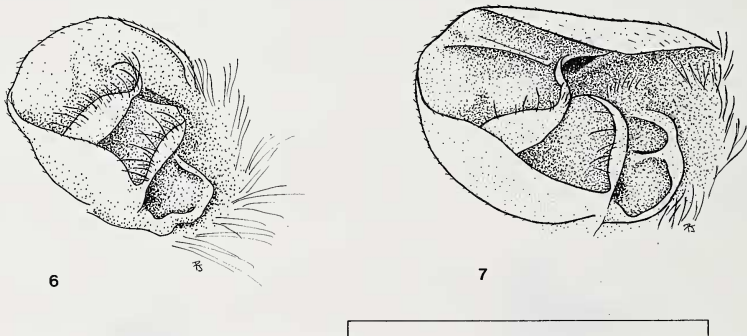


Figs. 4–5. *Crocidura yankariensis* (BM [NH] 55. 618); ventral aspects of forehand (4) and hindfoot (5). (Scale 10 mm)

Figs. 6 and 7. Hands and feet (Figs. 2, 3) covered with fine whitish hairs. Soles with six pads, naked (Figs. 4, 5). Toes of hindfeet very short, the whole hindfoot being only slightly larger than the outer ear. A considerable part of the tibia is free of long body hairs (Fig. 2), this being an important character for the external recognition of the species.

Tail short (67 % of HB), thick at its base, and densely covered with long bristles near to its tip. The colour of the tail is brownish dorsally, whitish ventrally.

The skull (Fig. 9) was described in detail earlier (HUTTERER and JENKINS 1980). We have little to add to our description except that we can give measurements of several complete skulls (Tab. 1). Of the four dental peculiarities that are present in *C. yankariensis*, three have proven to be constant: the very broad metacone on the fourth upper premolar, the minute third lower molar, and the first lower molar with proto- and metaconid close together. The presence of subsidiary cusps on the first and second upper molars is not constant, although most of the specimens have at least one subsidiary cusp on the outer edge of the first upper molar.



Figs. 6–7. Right ear of *Crocidura somalica* (holotype) (6) and of *Crocidura yankariensis* (BM [NH] 55. 618) (7). (Scale 10 mm)

Distribution. Known from Sudan savanna zone in Nigeria, Sudan, Ethiopia, Kenya and Somalia (see map, Fig. 8).

Habitat. Mainly from dry savanna, except specimen from Bahar Dar which is wet lush grassland with dense thickets and scattered boulders, frequently waterlogged in the wet season.

Remarks. *C. yankariensis* was present in various museum collections at least since the 1930's but was not recognised as such because of confusion with another poorly known

shrew – *C. somalica*. Specimens were incorrectly attributed to *C. somalica*, initially on the basis of the type description and perhaps later in comparison with previously misidentified material (see synonymy). In the BM(NH) collection, specimens of *C. yankariensis* had been variously misidentified as *C. somalica* (HAYMAN, 1937), *C. bicolor* Bocage, 1889 (CORBET and YALDEN 1972; YALDEN, LARGEN and KOCK 1976) or left unidentified. It was only after publication of the description of *C. yankariensis* based on owl pellet material, that the senior author discovered some of these misidentifications within several museum collections.

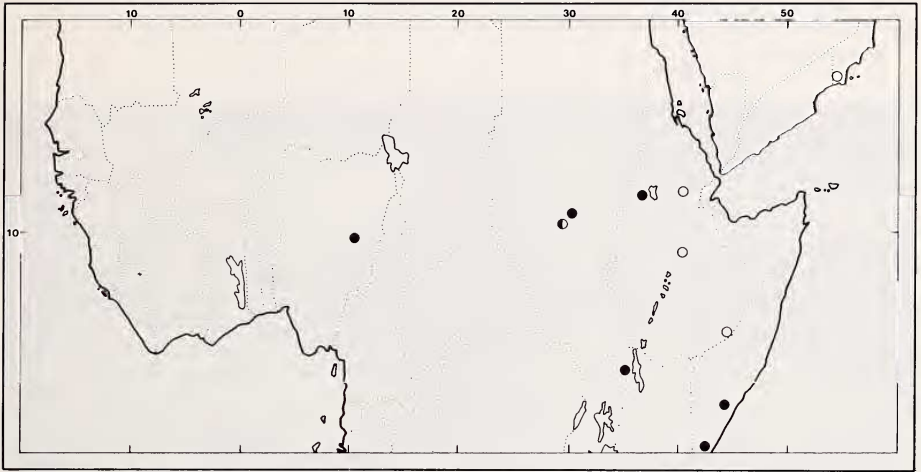


Fig. 8. Known distribution of *Crocidura somalica* (○) and *Crocidura yankariensis* (●); sympatric occurrence shown by ◐.

Comparisons. The following table summarizes the diagnostic characters of *C. somalica* and *C. yankariensis*. The skulls of both species are also shown in Fig. 9.

C. somalica

In profile, skull slopes gradually upwards from rostrum to back of braincase.

Anterior termination of rostrum forms an abrupt ca. 60° angle. Rostrum relatively long and slender.

Zygomatic process of maxilla not pronounced, subangular, aligned with paracone of M². Skull medium in width at this point.

Gradual increase in width from anterior part of interorbital region to posterior.

Superior articular facet of braincase subangular; without crest.

C. yankariensis

Gradual slope from rostrum to lacrymal region, interorbital region depressed, braincase increases in height sharply towards posterior.

Anterior termination rounded. Rostrum appears to be short due to anterior portion being slender, followed by pronounced protrusion in the maxilla above the anterior portion of the premolar.

Zygomatic process of maxilla well developed, angular, aligned with middle of M². Skull broad at this point.

Interorbital region a shallow curve from narrow anterior to broad posterior.

Well marked angular crest present.

C. somalica (continued)

Braincase sub-oval in dorsal view, its maximum width is at slightly over half of the distance from the superior articular facets. Occiput relatively deep, lambdoid crest sub-triangular.

Coronoid process of mandible medium in height and width. Dentition as in other crocidurines, lacks dental peculiarities of *C. yankariensis*.

C. yankariensis (continued)

Braincase parallel-sided from superior articular facets to two thirds along the braincase, which is the point of maximum width. Occiput relatively narrow, lambdoid crest forms shallow curve on dorsal surface of braincase.

Coronoid process high and broad, dorsally broad and bluntly terminated.

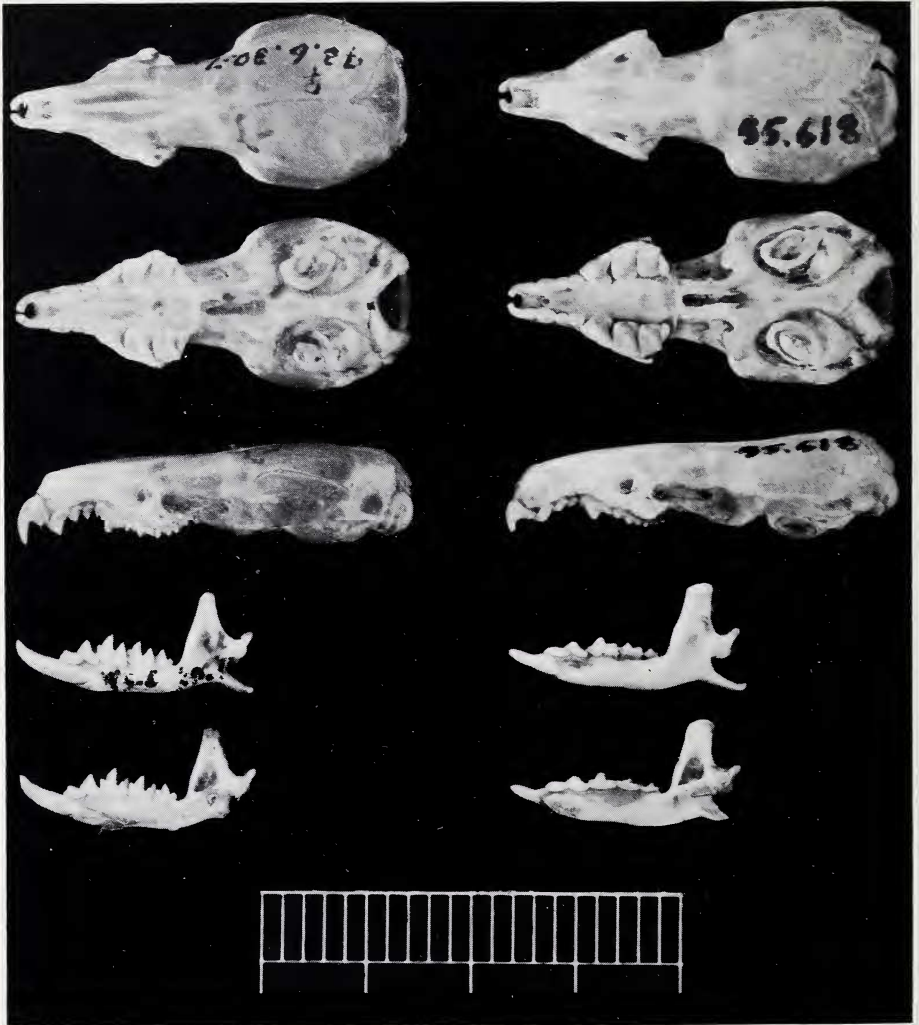


Fig. 9. Skulls of *Crocidura somalica* (holotype, BM [NH] 93.6.30.7.), on the left, and of *Crocidura yankariensis* (BM [NH] 55.618), on the right. (Scale 20 mm)

Table
External measurements and selected cranial measurements

	HB	T	HF	E	WT	CI	IW	GW	HCC	UTR		
					<i>Crocidura somalica</i>							
Ethiopia:												
	53	40	11.2	7.0	-	19.2	4.2	8.5	4.2	8.4	juv., holotype	
	63	42.5	12.1	7.2	-	20.1	4.4	8.7	4.4	8.7	juv.	
Kenya:	77	46	13	5.0	8	20.1	4.3	9.1	4.7	8.4	ad.	
Oman:	68	47	11.6	9.3	-	20.4	3.8	8.7	4.2	8.7	ad. (HARRISON 1980)	
					<i>Crocidura yankariensis</i>							
Sudan:												
	60	41	10.1	7.2	-	18.9	4.0	8.5	4.1	8.0	old ad.	
Ethiopia:	66	36	9.5	7.5	4.5	-	4.0	-	-	7.7	y. ad., pregnant	
Kenya:	55	35	9.5	6.5	-	-	3.9	-	-	7.8	old ad.	
Somalia:												
	52	40	10	6.5	-	-	-	-	-	-	ad.	
	53	40	9.8	6	-	18.8	4.0	8.2	4.0	8.4	ad.	
	?77	40	9	-	-	18.5	3.9	8.2	3.6	8.1	ad.	
	57.5	37	10	8	-	-	-	-	-	-	ad.	
	54	36	9.5	-	-	19.5	4.1	8.4	4.1	8.5	y. ad.	
	-	-	-	-	-	19.1	4.1	8.4	3.7	8.5	y. ad.	
	-	-	-	-	-	19.0	3.9	8.2	3.6	8.4	juv.	
	-	-	-	-	-	18.4	4.1	-	3.6	8.3	juv.	
	52	35.5	10	6	-	-	4.3	-	-	7.8	juv.	

Acknowledgements

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Zusammenfassung

Artgrenzen von Crocidura somalica Thomas, 1895 und
Crocidura yankariensis Hutterer und Jenkins, 1980 (Insectivora: Soricidae)

Die Beschreibung der nach Schädelmaterial aufgestellten Spitzmausart *Crocidura yankariensis* wird anhand vollständigeren Materials ergänzt, vor allem die äußeren Merkmale der Art betreffend. Fehlbestimmtes Material in verschiedenen Museen zeigt weiterhin, daß die aus Nigeria beschriebene Art eine viel weitere Verbreitung hat; neue Funde liegen aus Sudan, Äthiopien, Kenia und Somalia vor. Da Verwechslungen vor allem mit der ähnlichen Art *C. somalica* vorkamen, wird das Wissen über diese Art zusammengefaßt, und es werden die Artgrenzen für beide definiert.

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Untersuchungen zur Echoortung im Gruppenflug bei Mausschwanzfledermäusen (*Rhinopoma microphyllum*)

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Abstract

Echolocation behaviour during group flight in Rhinopoma microphyllum (Chiroptera)

Investigated were the echolocation sounds of *Rhinopoma microphyllum* during single and group flights under laboratory conditions. In a 3-m-flight-tunnel and when flying in a large room exclusively FM-sounds with 5 to 7 harmonics were registered. Each of the 6 experimental animals had an individual frequency range of the harmonics that remained unchanged during group flights. Duration and temporal pattern of the sounds did not alter under these conditions either.

The only response to the acoustic activity of conspecifics consisted in a rise of sound intensity up to 20 dB. A similar reaction was observed when flying in the presence of noise.

Einleitung

Die insektenfressende Große Mausschwanzfledermaus, *Rhinopoma microphyllum*, besiedelt aride Gebiete von Indien bis zum Sudan (HARRISON 1964). Sie bewohnt Höhlen und alte Bauwerke in Kolonien, die mehr als 1000 Individuen umfassen können (BROSSET 1961). KULZER (1966) untersuchte die Anpassung von *Rhinopoma* an das Wüstenklima; weitergehende Untersuchungen zur Biologie dieser Fledermaus fehlen.

Aus morphologischen Gründen werden die Vertreter der Familie Rhinopomatidae zu den primitivsten Fledermausformen gerechnet (FINDLEY et al. 1972; KOOPMAN 1982). Auch die Ortungslaute, die erstmals von MÖHRES und KULZER (1956) beschrieben wurden, werden wegen ihrer flachen Frequenzmodulation und des Aufbaus aus vielen Harmonischen als ursprünglich angesehen (SIMMONS 1980).

HABERSETZER (1981) beobachtete bei Freilanduntersuchungen an *R. hardwickei*, daß außer dem im Labor zu registrierenden kurzen FM-Laut, im freien Gelände auch ein langer, konstantfrequenter Ortungslaut (CF-Typ) vorkommt. Fliegen mehrere Mausschwanzfledermäuse dicht beisammen, verlagern sie die Frequenz dieses Lautes so, daß keine Frequenzüberschneidung zwischen den einzelnen Individuen auftritt.